

Message Text

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ACTION EB-07

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C O N F I D E N T I A L PARIS 19298

USOECD

EXCON

E.O. 11652: XGDS1
TAGS: ESTC, COCOM , GE, GW, UR
SUBJ: GERMAN CRYSTAL GROWINGMACHINES TO USSR AND GDR-
IL 1355

REFS: A) STATE 99160, B) COCOM DOC. (77) 129, C) SCOM
DOC. (77) 505

1. GERMAN DEL HAS RESPONDED TO COMMENTS REFTEL AS
FOLLOWS;

" WHEN THE "LIQUID ENCAPSULATION TECHNIQUE" IS
USED FOR THE GROWING OF GALLIUM-ARSENIDE CRYSTALS,
THE LIQUID GALLIUM-ARSENIDE IS COVERED BY LIQUID BORON
OXIDE (BORAX). THE SEED CRYSTAL IS DUMPED THROUGH
THE BORAX INTO THE MELT AND THE CRYSTAL IS SLOWLY
PULLED UPWARDS. THE BORON OXIDE IS TO PREVENT BOTH
THE EVAPORATION OF THE ARSENIC FROM THE MELT AND THE
CONDENSATION OF THE ARSENIC UPON THE WALLS OF THE
CHAMBER.

SINCE THE HEATING OF THE CRUCIBLE IS PERFORMED BY RE-
SISTANCE HEATING ON THE SURFACE OF THE CYLINDER AND
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SINCE THE CRYSTAL IS GROWN IN THE AXIS OF THE CRUCIBLE,
THERE ALWAYS APPEARS A TEMPERATURE GRADIENT FROM THE
CRUCIBLE WALL TOWARDS THE CENTER, EVEN IN STATIONARY
SITUATION. WHEN THE GALLIUM-ARSENIDE IN THE CRUCIBLE
AXIS IS HEATED UP TO MELTING TEMPERATURE, IT IS HEATED
OVER THE MELTING POINT AT THE BORDER OF THE CRUCIBLE
AND A VAPOR PRESSURE ARISES WHICH IS HIGHER THAN 1 BAR.

IN ORDER NOT TO DISTURB THE STOICHIOMETRIC EQUILIBRIUM OF THE GALLIUM AND OF THE ARSENIC WITHIN THE GALLIUM-ARSENIDE, A PRESSURE MUST BE EXERCISED FROM THE OUTSIDE WHICH IS DISTINCTLY HIGHER THAN THE VAPOR PRESSURE WHICH CORRESPONDS TO THE HIGHER TEMPERATURE IN THE MELT.

THEREFORE, GALLIUM-ARSENIDE IS GROWN ONLY IN CRUCIBLES OF SMALL DIAMETERS, WHEREBY AN OVERPRESSURE IS NECESSARY WHICH IS DISTINCTLY OVER 1 BAR.

WITH THE LARGE CRUCIBLES OF THE CRYSTAL GROWING MACHINE TYPE EKZ 1600/1700 SI 270 MILLIMETERS DIAMETER, A TEMPERATURE GRADIENT (I.E. A TEMPERATURE ON THE CRUCIBLE WALL) WOULD ARISE, WHICH WOULD BE FROM 50 DEGREES C TO 100 DEGREES C HIGHER THAN THE MELTING TEMPERATURE IN THE CENTER OF THE MELT. AN EVEN HIGHER OUTSIDE PRESSURE WOULD THEN BE REQUIRED.

BUT EVEN A SMALLER CRUCIBLE CAN NOT BE USED IN THE TYPE EKZ 1600/1700 SI CRYSTAL GROWING MACHINE, BECAUSE THE DISTANCE BETWEEN THE HEATING EQUIPMENT AND THE CRUCIBLE WOULD BE TOO LONG AND THE REQUIRED TEMPERATURE GRADIENT COULD NO LONGER BE ATTAINED. ACCORDING TO THE KNOWLEDGE AND EXPERIENCES MADE BY GERMAN TECHNICAL EXPERTS, GALLIUM-ARSENIDE IS CONFIDENTIAL

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ALWAYS GROWN AT A PRESSURE BETWEEN 2 AND 3 BAR IN CRUCIBLES OF SMALL DIAMETER. WE DO NOT KNOW OF ANY PRODUCER GROWING GALLIUM-ARSENIDE WITH UNDERPRESSURE. CONSIDERING ALL FACTORS MENTIONED ABOVE, WE CAN NOT UNDERSTAND THE REMARK MADE BY THE UNITED STATES DELEGATE (RECORDED IN COCOM DOC. (77) 129.5, PARA. 1) THAT "A PRESSURE OF ONLY 1/3 ATMOSPHERE ABSOLUTE IN THE GROWTH CHAMBER WOULD SUFFICE TO CONTAIN ARSENIC IN THE MELT COVERED BY BORON OXIDE AND PERMIT THE BULK GROWTH OF GALLIUM-ARSENIDE." THE BORON OXIDE LAYER WOULD HAVE TO BE THICKER THAN 1 METER IN ORDER TO COMPENSATE THE VAPOR PRESSURE BY ITS WEIGHT.

FOR THESE REASONS, THE PRODUCTION OF GALLIUM-ARSENIDE CRYSTALS IS NOT POSSIBLE WITH THIS CRYSTAL GROWING MACHINE.

IT IS ONCE AGAIN POINTED OUT THAT IDENTICAL CRYSTAL GROWING MACHINES HAVE BEEN EXPORTED BEFORE TO THE USSR WITH THE COMMITTEE'S UNANIMOUS APPROVAL (SEE COCOM DOC. (75) 1796 AND (76) 518)."

2. GERMAN AUTHORITIES NOW VIEW THESE CASES AS URGENT AND
REQUEST U.S. VIEWS BY JULY 8.

3. ACTION REQUESTED: U.S. VIEWS BY JULY 8.
SALZMAN

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